ANIMAS RIVER #1 & #2 (GOLD MEDAL AND STANDARD REACHES)

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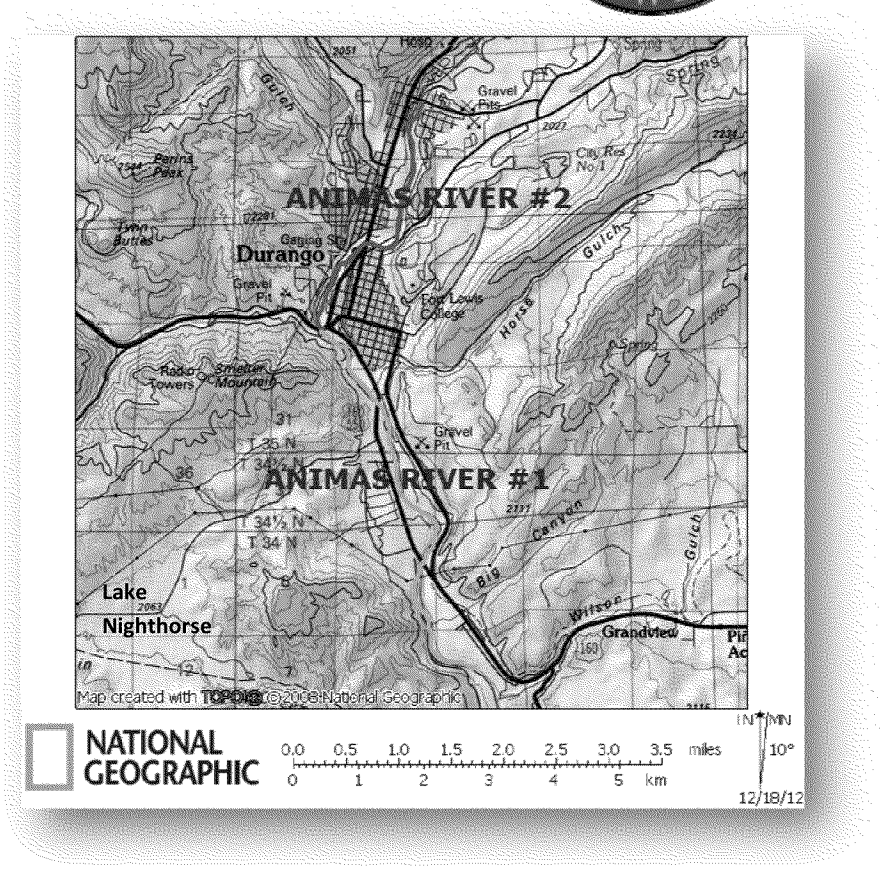
Southwest Region

Water: Animas River
Sampling Date: 9/9/14 to 9/18/14
Gear: Raft Electrofishing (2.5 GPP with throwable anode)
Drainage: San Juan
Water Code: 37982 (#1) and 37994 (#2)



OBJECTIVE

To assess the density, biomass, and demographics of trout and native fishes in the standard (Animas #2) and special regulation (Animas #1; Gold Medal) reaches of the Animas River by 2 pass mark and recapture raft electrofishing.

HISTORY

The Animas River has a long history of poor water quality associated with historic mining in the Silverton District, pollution from the smelter processing facility in Durango, and city waste discharges directly into the river. In fact, Durango gets the majority of its water from the Florida River because at one time the water quality in the Animas River was once so bad it was unfit for domestic use. Water quality has obviously changed today but as early as the 1960s the river was thought to support only the occasional trout. Today the river through Durango supports a variety of aquatic life including caddis and stoneflies. But one does not have to travel far upstream to find ongoing impacts from historic mining in Silverton. At Bakers Bridge, located about 17 miles north of town, a number of dissolved heavy metal water quality standards are frequently exceeded and trout populations are extremely low above this point.

Water development and depletions on the Animas River were few until the Animas-LaPlata project's main feature, Ridges Basin Dam, was completed in 2007. The dam is built in just west of Durango in an off channel site on Basin Creek (see map). Limited pumping began in the fall of 2008 with full pumping of 280 cfs from the Animas River started in June 2009. The reservoir, Lake Nighthorse (named after former Colorado Senator Ben Nighthorse Campbell), is now full. The reservoir holds 120,000 acre feet of water, most of which satisfies Tribal water rights. Currently, there is little demand for the stored water so pumping operations are on hold except to replace evaporative loss. Water depletions from pumping occur in the Gold Medal reach of the Animas River (#1).

MANAGEMENT

The Animas River is split into two management sections through the City of Durango; the Animas River #1 (Gold Medal reach or GM) and the Animas River #2 (Standard Regulation reach or ST). The Animas #1, or Gold Medal Reach, starts from the confluence of Lightner Creek just below the Highway 160 Bridge and ends at Riviera Bridge behind Home Depot. This 4.4 mile reach of river is managed with a two-fish 16 inches or greater bag limit and artificial fly and lure only. The management goal is to provide anglers an excellent opportunity to capture abundant quality fish as measured by statewide Gold medal criteria. Gold Medal streams on average should consistently produces 60 pounds of trout per surface acre or more and 12 fish greater than or equal to 14 inches per surface acre of river.

Angler use and catch in the Animas River sections is estimated by conducting intensive creel surveys. In the 2012 creel census of the Gold Medal reach, rainbow trout consist of 79% of fish captured by anglers and brown trout 17%; catch rates average about 0.9 fish per hour (5,400 total fish captured). An estimated 2,124 anglers fished the Animas River Gold Medal reach from July-October in 2012, which was only about a 9% increase in angler numbers since the last census in 1997. Those anglers released virtually all of the trout captured despite regulations allowing for the harvest of 2 trout over 16 inches per angler day.

Natural reproduction of trout in the Animas River is poor and the fishery is supported by stocking fingerling fish with the goal of growing and sustaining wild trout in the river. Stocking on the Animas River #1 consists generally of 10k brown trout and 10k rainbow trout fingerlings each year. These fish are distributed by raft in June and July. Since 2005 approximately 10k Colorado cutthroat trout fingerlings have been stocked annually.

The Animas River #2, or Standard Reach (ST), is managed with standard statewide regulations on trout that allow the use of bait and a 4 trout daily bag limit (no size restrictions). This 2.7 mile reach of the Animas River unofficially begins at 32nd Street in north Durango and continues downstream to the Lightner Creek confluence just below Highway 160. The management goal for this reach of stream is to provide increased opportunity to harvest trout. However, this section is capable of supporting both the biomass and quality sized trout that the GM section does downstream. Although the regulation allows for more harvest of trout, few anglers actually take advantage of the harvest opportunity.

Angler catch and demographics are similar between the Gold Medal and Standard management sections. The 2012 creel census estimated angler numbers at 1,461, an 11% drop in anglers since 1997. Anglers reported catching 76% rainbows, 23% brown trout, and 1% Snake River cutthroats. Total fish caught was estimated at a little over 6,000 fish but 98% were released; up from approximately 72% of trout released in 1997. Catch rates were reported at 1.7 fish caught per hour by an angler, most of these were rainbows (73%).

Stocking over the past 10 years in the Standard Reach varies but generally 10k rainbow and 10k brown trout fingerlings are stocked by raft each year in the Animas #2. Since 2005 we have been stocking approximately 10k Colorado cutthroat trout fingerlings in addition to the browns and rainbows. Because of the higher use associated with Standard Bag limits in an Urban Area, an average of 2,000 catchable rainbow trout have been stocked annually.

A whirling disease resistant rainbow trout is used for stocking. Because the whirling disease (WD) resistant fish, or Hofer strain, is highly domesticated it is cross breed with a wild strain of rainbow trout to produce a hybrid WD fish. These "Hofer crosses" have been stocked since 2008 with the hope of establishing a wild and self-reproducing population of rainbows in the WD positive Animas River.

GOLD MEDAL (ANIMAS #1) RESULTS

A total of 780 fish were captured in the Gold Medal reach between Cundiff Park and the Hwy. 550 High Bridge (Table 1). The most abundant fish captured were rainbow trout (66%), followed by bluehead sucker

Table 1. 2014 Summary Report for the Gold Medal Reach of the Animas River #1.

Stream Sampling Summary Report

Water: 37982 ANIMAS RIVER #1

Station: SJ1998

Drainage: San Juan River

Date: 9/9/2014

Coordinates at Lower End of the Sampling Station

Zone:	13s	X:	245509
Y:	4124884	Elevation:	6392 ft
Length:	6336 ft	Width:	100.00 ft
Area:	14.55 ac	Effort:	
Metric:		Protocol:	MARK/RECAPTURE
Gear/Methods:	BTEF		

Notes:

Biennial fish inventory on 1.3 miles of the Animas River. This reach of the river is managed with a 2 fish over 16 inch bag limit and is designated as one of Colorado's Gold Medal streams. Flows were optimal on the marking run on 9/9/14 at 273 cfs but jumped to over 1200 cfs due to local flash flooding caused by Hurricane Norbert. The recapture run was done on 9/12/14 when flows dropped just below 500 cfs and the water clarity improved. GPP settings were low range, 30% of Range and 60 PPS which worked really well at 640 microseimens cond. (64F).

PROPORTIONAL STOCK DENSITY and QUALITATIVE STOCK DENSITIES

Species	Total Number	Proportional Stock Density (%)	Percent Stock Size	Percent Quality Size	Percent Preferred Size	Percent Memorable Size	Percent Trophy Size	Maximum Size (inches)
BLUEHEAD SUCKER	108	0.00						17.91
FLANNELMOUTH SUCKER	1	0.00						20.67
BROWN TROUT	82	92.68	7.32	26.83	19.51	14.63	31.71	23.23
MOTTLED SCULPIN	51	0.00						4.72
RAINBOW TROUT	531	6.76	93.24	5.41	1.35			21.26
WHITE SUCKER	7	100.00		71.43	28.57			14.37

MEAN, MINIMUM AND MAXIMUM VALUES FOR LENGTHS AND WEIGHTS

SPECIES	Total Sampled	Mean inches	Mean lbs	Minimum inches	Minimum lbs	Maximum inches	Maximum lbs
BLUEHEAD SUCKER	108	14.73	1.41	6.69	0.11	17.91	2.85
FLANNELMOUTH SUCKER	1	20.67	3.18	20.67	3.18	20.67	3.18
BROWN TROUT	82	14.66	1.58	7.87	0.19	23.23	6.00
MOTTLED SCULPIN	51	3.57		1.57	0.00	4.72	0.00
RAINBOW TROUT	531	8.22	0.28	5.91	0.07	21.26	4.12
WHITE SUCKER	7	11.82	0.81	10.24	0.49	14.37	1.53

RELATIVE ABUNDANCE and CATCH PER UNIT EFFORT

Species	Total sample	Population >= cutoff	Population all sizes	Weight Lb	Percent Number	Percent Weight	Catch per Unit Effort Number/Effort	Catch per Unit Effort Lbs/Effort
BLUEHEAD SUCKER	108	896	896	1,260.11	17.53	52.29		
FLANNELMOUTH SUCKER	1	1	1	3.18	0.02	0.13		
BROWN TROUT	82	114	115	180.45	2.23	7.49		
MOTTLED SCULPIN	51	689	689	0.00	13.48	0.00		
RAINBOW TROUT	531	3393	3422	952.23	66.39	39.52		
WHITE SUCKER	7	17	17	13.82	0.33	0.57		

RELATIVE ABUNDANCE and BIOMASS ESTIMATES

Species	Total sample	Population estimate	Weight Lb	Percent Number	Percent Weight	Biomass Lb/Acre	Num/ Acre	Num/Mile	Fish samples No/Acre < T	Fish samples No/Acre >=T	T
BLUEHEAD SUCKER	108	896	1,260.11	17.53	52.29	86.63	61.60	746.67	0	7	150
FLANNELMOUTH SUCKER	1	1	3.18	0.02	0.13	0.22	0.07	0.83	0	0	150
BROWN TROUT	82	114	180.45	2.23	7.49	12.41	7.84	95.00	0	6	150
MOTTLED SCULPIN	51	689	0.00	13.48	0.00	0.00	47.37	574.17	0	4	
RAINBOW TROUT	531	3393	952.23	66.39	39.52	65.47	233.27	2,827.50	2	37	150
WHITE SUCKER	7	17	13.82	0.33	0.57	0.95	1.17	14.17	0	0	150

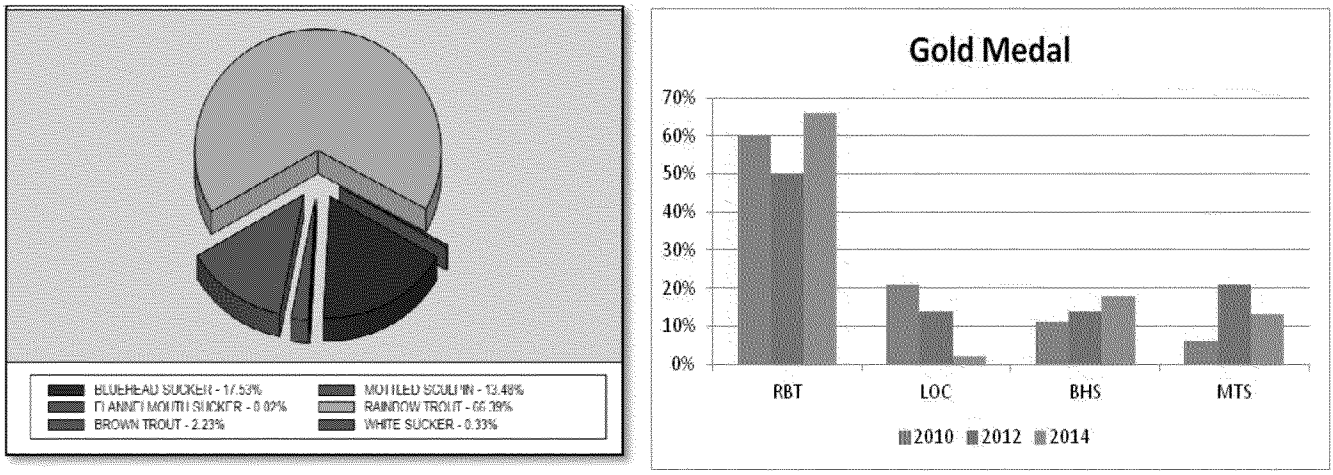


Figure 1. Percent species composition of fishes in the Gold Medal Reach during the 2014 fish survey (left) and composition since 2010 (right).

(17%), mottled sculpin (13%), and brown trout (2%; Figure 1). Brown trout showed the most precipitous drop from 20% of the catch in 2010 to only 2% of the catch this year (Figure 1; right). Although the combined biomass of trout was sufficient to reach Gold Medal (GM) standards (75 lbs), the number of quality fish per surface area was almost half of what is needed to maintain GM standards (7 fish≥14 in per surface acre; Figure 2 and Table 2).

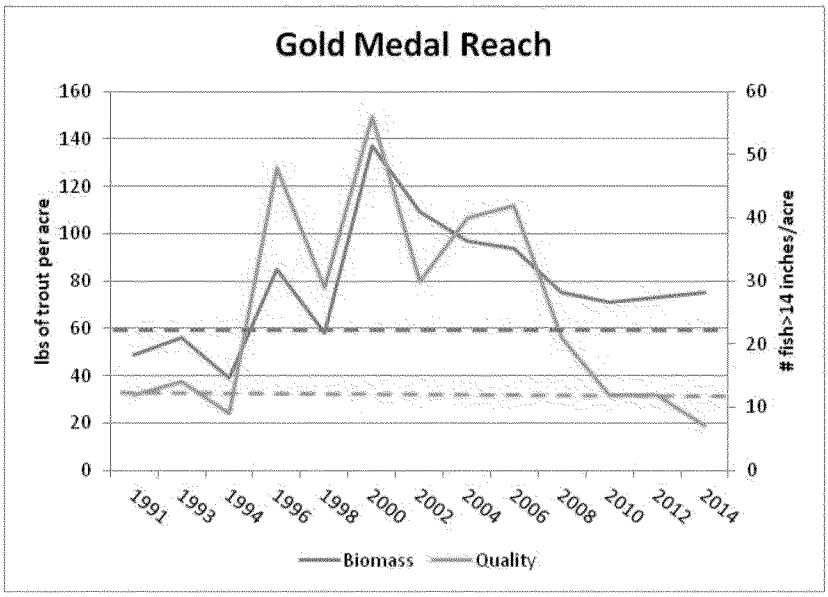


Figure 2. Biomass versus quality of trout in the Animas River Gold Medal Reach. Dashed lines are the minimum number of fish (yellow) or biomass (blue) needed to meet Gold Medal criteria for a Colorado stream.

The density of fish in the Animas River Gold Medal section was 131 fish per mile for brown trout over 6 inches and 3,104 rainbows per mile in the same size category (Table 2). Brown trout density dropped by 59% relative to 2012 while rainbow trout density increased by 40%. Most of the increases in rainbow trout numbers were from fish less than 200 mm (Figure 3).

Table 2. Historic fish survey metrics for the Animas River #1 (Gold Medal) and Animas River #2 (Standard Regulation) reaches.

Animas #1 Gold Medal	1991	1993	1994	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014	
Month/Year	Oct-91	Nov-93	Sep-94	Sep-96	Sep-98	Sep-00	Nov-02	Nov-04	Sep-06	Sep-08	Sep-10	Sep-12	Sep-14	Average
All trout combined (fish/acre)	60	55	48	134	44	131	51	90	141	73	148	210	267	112
All trout combined (fish/mile)	724	660	590	1626	530	1592	617	1089	873	887	1792	2545	3235	1289
Total trout biomass (lbs/acre)	49	56	39	85	58	137	109	97	94	75	71	73	75	78
All trout > 14 inches (fish/acre)	12	14	9	48	29	56	30	40	42	21	12	12	7	26
Rainbows> 14 inches (fish/acre)	7	4	5	31	6	21	11	29	28	10	5	3	2	12
Animas #2 Standard	1991	1993	1994	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014	
Month/Year	Oct-91	Nov-93	Sep-94	Sep-96	Sep-98	Sep-00	Nov-02	Nov-04	Sep-06	Sep-08	Sep-10	Sep-12	Sep-14	Average
All trout combined (fish/acre)	*147*	*43*	*122*	*66*	*38*	*57*	*130*	*115*	*84*	*97*	*56*	*73*	*65*	*84*
All trout combined (fish/mile)	*1779*	*520*	*1476*	*799*	*460*	*690*	*1573*	*1392*	*1406*	*1171*	*720*	*880*	*797*	*1051*
Total trout biomass (lbs/acre)	*115*	*32*	*56*	*41*	*28*	*42*	*99*	*104*	*115*	*58*	*32*	*41*	*27*	*61*
All trout > 14 inches (fish/acre)	*37*	*12*	*10*	*11*	*12*	*16*	*38*	*17*	*34*	*13*	*4*	*4*	*3*	*16*
Rainbows> 14 inches (fish/acre)	*3*	*2*	*2*	*2*	*6*	*5*	*10*	*7*	*11*	*4*	*0.2*	*0.4*	*0*	*4*

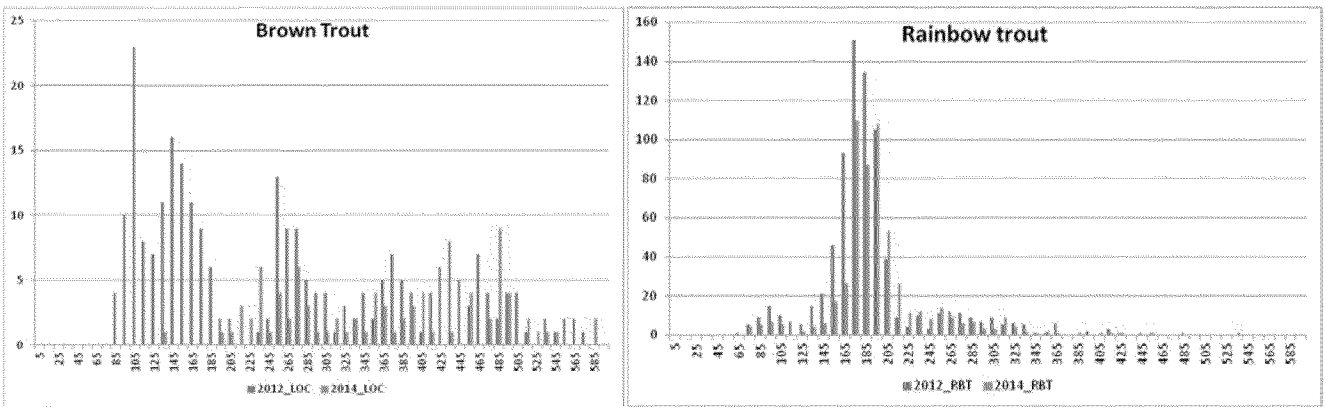


Figure 3. Length frequency of brown (left) and rainbow (right) trout captured in 2012 and 2014 fish surveys in the Gold Medal Reach.

Age-0 (80-135 mm) and Age 1 (145-180 mm) brown trout were not captured or rare in the Gold Medal reach during this years' survey (Figure 3; left-yellow bars). In 2012, both age classes were abundant (Figure 3; left-blue bars). Rainbow trout showed the opposite demographic pattern with abundant Age-0 (60-125 mm) and Age-1 (130-200) fish present but few older fish (Figure 3; right). This pattern was similar to what we saw 2 years ago in 2012.

Relative weight describes a fish's body condition relative to a standard weight of that species. Relative weights well below 100 suggest feeding conditions are not optimal; conditions above suggests under utilization of prey most likely as a result from low densities of fish (i.e., completion for food is low). Brown and rainbow trout under 300 mm averaged just at 98. Browns over 300 mm TL averaged 110 while rainbows at that same size were 97 (Figure 4). Most of the browns over 300 mm were in spawning condition which probably accounted for their higher relative weights.

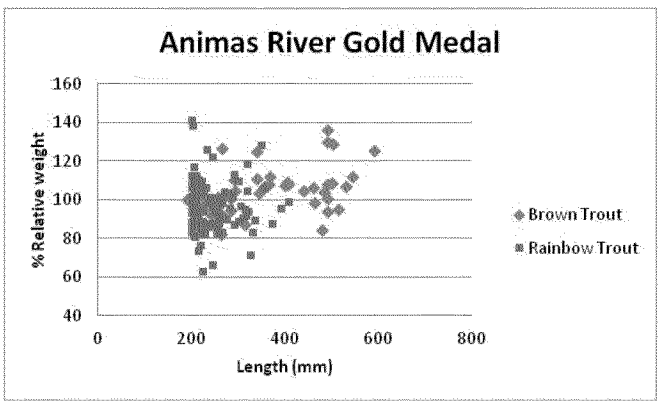


Figure 4. Relative weight of brown and rainbow trout.

STANDARD REACH (ANIMAS #2) RESULTS

A total of 358 fish were captured in the Animas River Standard Regulation reach (Animas #2; Table 3). The composition of the catch in order of relative abundance was rainbow trout (50%), mottled sculpin (17%), brown trout (15%), white sucker (13%), and bluehead sucker (4%; Table 3). The relative abundance of rainbow and brown trout and bluehead sucker has declined in this reach since 2010 (Figure 5).

Table 3. Summary report for the Animas River #2.

Stream Sampling Summary Report

Water: 37994 ANIMAS RIVER #2

Station: SJ2356

Drainage: San Juan River

Date: 9/8/2014

Notes: Biennial fish inventory on 1.3 miles of the Animas River. This reach of the river is managed with standard regulations. Flows were optimal on the marking run on 9/8/14 at 273 cfs but jumped to over 1200 cfs due to local flash flooding caused by Hurricane Norbert. The recapture run was done on 9/18/14 when flows dropped to 332 cfs and the water clarity improved. GPP settings were low range, 30% of Range and 60 PPS which worked really well at 640 microseimens cond. (64F).

Coordinates at Lower End of the Sampling Station

Zone:	X:	Y:	Elevation:
13s	244241	4129202	6510 ft

Length:	Width:	Area:
7920 ft	100.00 ft	18.18 ac

Effort: **Metric:** **Protocol:** MARK/RECAPTURE

Gear/Methods: BTEF

PROPORTIONAL STOCK DENSITY and QUALITATIVE STOCK DENSITIES

Species	Total Number	Proportional Stock Density (%)	Percent Stock Size	Percent Quality Size	Percent Preferred Size	Percent Memorable Size	Percent Trophy Size	Maximum Size (inches)
BLUEHEAD SUCKER	23	0.00						17.32
FLANNELMOUTH SUCKER	1	0.00						20.08
BROWN TROUT	74	67.57	32.43	39.19	13.51	8.11	6.76	22.44
MOTTLED SCULPIN	33	0.00						4.29
RAINBOW TROUT	194	0.00	100.00					13.39
WHITE SUCKER	28	82.14	17.86	14.29	25.00	42.86		18.50
WHITE-BLUE SUCKER HYBRID	2	0.00						16.38
WHITE-FLANNELMOUTH HYBRID	3	0.00						18.90

MEAN, MINIMUM AND MAXIMUM VALUES FOR LENGTHS AND WEIGHTS

SPECIES	Total Sampled	Mean inches	Mean lbs	Minimum inches	Minimum lbs	Maximum inches	Maximum lbs
BLUEHEAD SUCKER	23	14.48	1.30	11.22	0.63	17.32	2.41
FLANNELMOUTH SUCKER	1	20.08	2.83	20.08	2.83	20.08	2.83
BROWN TROUT	74	10.91	0.71	5.98	0.08	22.44	4.30
MOTTLED SCULPIN	33	3.14		1.97	0.00	4.29	0.00
RAINBOW TROUT	194	9.97	0.45	5.91	0.09	13.39	1.03
WHITE SUCKER	28	14.18	1.48	7.48	0.19	18.50	2.78
WHITE-BLUE SUCKER HYBRID	2	12.32		8.27	0.00	16.38	0.00
WHITE-FLANNELMOUTH HYBRID	3	17.45		16.14	0.00	18.90	0.00

RELATIVE ABUNDANCE and CATCH PER UNIT EFFORT

Species	Total sample	Population >= cutoff	Population all sizes	Weight Lb	Percent Number	Percent Weight	Catch per Unit Effort Number/Effort	Catch per Unit Effort Lbs/Effort
BLUEHEAD SUCKER	23	70	70	91.38	4.18	9.37		
FLANNELMOUTH SUCKER	1	0	0	0.00	0.00	0.00		
BROWN TROUT	74	253	266	179.39	15.10	18.40		
MOTTLED SCULPIN	33	285	285	0.00	17.01	0.00		
RAINBOW TROUT	194	839	869	379.36	50.07	38.91		
WHITE SUCKER	28	220	224	324.94	13.13	33.32		
WHITE-BLUE SUCKER HYBRID	2	3	3	0.00	0.18	0.00		
WHITE-FLANNELMOUTH HYBRID	3	5	5	0.00	0.30	0.00		

RELATIVE ABUNDANCE and BIOMASS ESTIMATES

Species	Total sample	Population estimate	Weight Lb	Percent Number	Percent Weight	Biomass Lb/Acre	Num/ Acre	Num/Mile	Fish samples No/Acre < T	Fish samples No/Acre >=T	T
BLUEHEAD SUCKER	23	70	91.38	4.18	9.37	5.03	3.85	46.67	0	1	150
FLANNELMOUTH SUCKER	1	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	150
BROWN TROUT	74	253	179.39	15.10	18.40	9.87	13.92	168.67	1	4	150
MOTTLED SCULPIN	33	285	0.00	17.01	0.00	0.00	15.68	190.00	0	2	
RAINBOW TROUT	194	839	379.36	50.07	38.91	20.86	46.15	559.33	2	11	150
WHITE SUCKER	28	220	324.94	13.13	33.32	17.87	12.10	146.67	0	2	150
WHITE-BLUE SUCKER HYBRID	2	3	0.00	0.18	0.00	0.00	0.17	2.00	0	0	
WHITE-FLANNELMOUTH HYBRID	3	5	0.00	0.30	0.00	0.00	0.28	3.33	0	0	

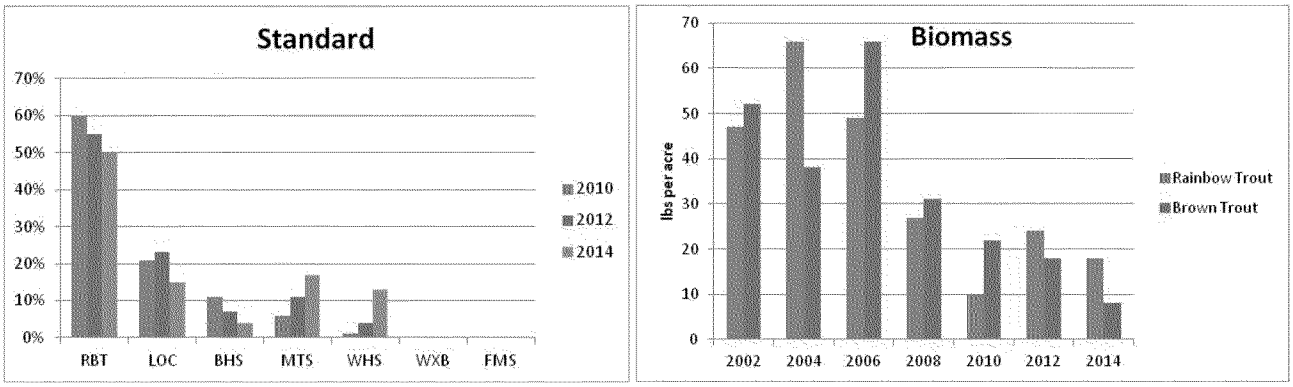


Figure 5. Percent species composition of fishes from 2010 – 2014 (left panel) and biomass of rainbow and brown trout (right panel) captured in the Standard Regulation reach of the Animas River.

Since 2002, the biomass of brown trout in the Standard reach has declined from a high of about 65 lbs per acre in 2006 to a low of only 8 lbs this year. Rainbow trout biomass has followed the same pattern from a high of 66 lbs per acre in 2004 to only 18 lbs/ac this year. The historic drop in biomass on average for rainbows was 20% and 76% for brown trout in this reach (N=22 survey years).

The estimated density or fish per mile of brown trout in the Standard reach was 169 fish per mile compared to 559 fish per mile for rainbow trout. Historic average brown trout density is 427 f/mi and for rainbows it is 476 f/mi. On a percentage basis brown trout numbers are down by about 60% while rainbow trout numbers are up about 17% over the historic average density.

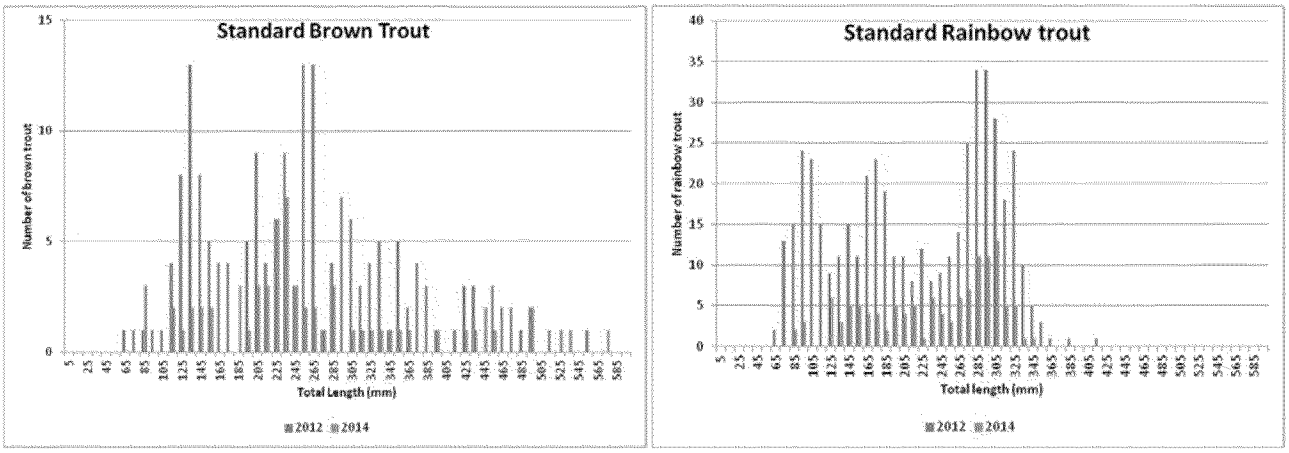


Figure 6. Length frequency for brown (left) and rainbow (right) trout in the Standard Regulation reach of the Animas River during the 2012 and 2014 fish surveys.

Young brown trout (Age-0&1), although present, were much reduced in abundance compared to 2012 (Figure 6). Older and larger browns were also less abundant than 2012. Essentially the same pattern could be seen for rainbow trout as well. Fewer fish in all age classes were captured in 2014 compared to 2012 (Figure 6; right). In the past 2 years, very few rainbow trout have exceeded the 14 inch quality standard, which holds true for the Gold Medal Reach as well.

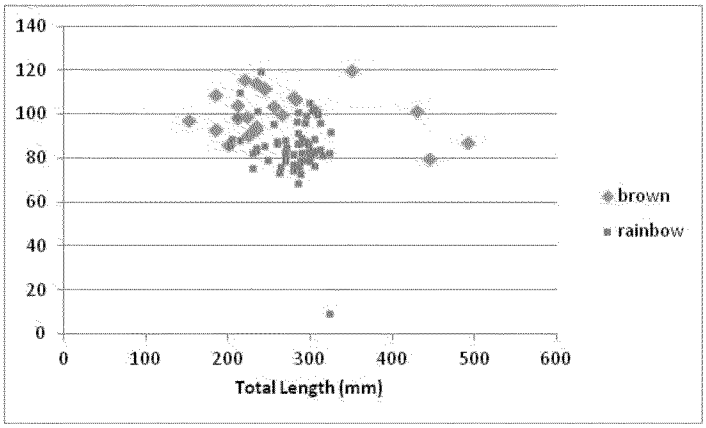


Figure 7. Relative weight index of brown and rainbow trout in the Animas River #2, Sept. 8th, 2014.

Brown trout were in average body condition with a relative weight index value of 101. However, two of the largest individuals (17.5 and 19.4 in) had a body index of 80 and 87 which is below average. Brown trout in early September should have the highest body condition factor for the year just before the spawning season begins in early October. Rainbow trout body condition averaged 86% of what would be considered a "standard" weight.

NATIVE FISH RESULTS

A total of 131 BHS, 2 FMS, 39 WHS, and 5 sucker hybrids were captured in the Animas River in 2014. On average (1993-2014 data), declines in total native suckers captured this year ranged from 38% for bluehead sucker to 84% for flannelmouth sucker. White sucker relative abundance was up about 50% from average total numbers captured in the past and hybrid suckers remained about the same as the long-term average of 5 hybridized fish capture per survey year.

Most of the bluehead suckers captured were adult fish. In 2012 we saw some evidence of young of the year or possibly Age-1 BHS around 100-145 mm but this year we did not capture any suckers in that size range (Figure 8). The two flannelmouth suckers captured were large (20+ inches) and old adult fish.

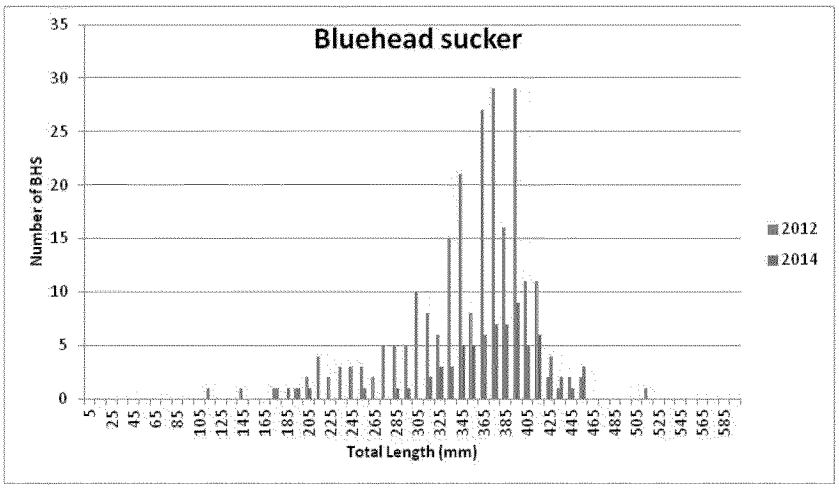


Figure 8. Length frequency chart of bluehead sucker captured in 2012 and 2014 on the Animas River #1 and #2 combined.

CONCLUSIONS

The steady decline in the number and size of trout in the Animas River since 2006 is alarming and complex. At the same time we see the density of brown trout declining we also see young rainbow trout flourishing in the Animas River but they don't seem to be able to get much past 2 years old. The biomass divide between the Standard and Gold Medal section continues to widen. These two sections are in close proximity to one another and the in-stream physical habitat is similar. Despite the different regulations allowing a more liberal harvest in the Standard reach, creel surveys suggest there is little substantial difference in harvest between the two sections yet the biomass of the Standard reach was almost 70% below what was estimated in the Gold Medal section this year. Native fishes also appear to be on the decline with total numbers of fish captured dropping from 40% for bluehead sucker to almost 80% for flannelmouth sucker.

The Animas River is a complex system with water quality impairments ranging from dissolved heavy metals, to heavy local sediment inputs, and occasional water temperature exceedences. The river is also a free flowing system subjected to all of the stochastic events a natural system can throw at it. The fish population in the Animas River reflects these variations sometimes fluctuating 3-4 times in fish density between surveys (Figure 9). However, from about 1998 through 2006 there was a period of relative stability in both trout numbers and the number of quality sized individuals in the Standard and Gold Medal reaches (albeit, brown trout numbers and biomass in the GM reach appears to be in decline from about 2000 on). The question is, "What are the underlying factors precluding the recruitment of young brown and rainbow trout into older/quality size age classes anglers expect to catch?" And, the follow-up question is; "What are the management prescriptions needed to address these limiting factors in the Animas River?"

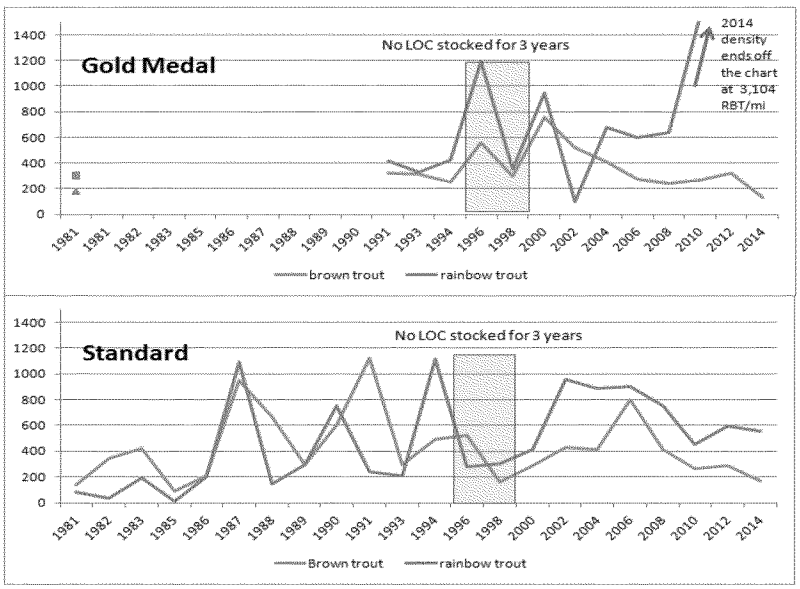


Figure 9. A historic comparison of fish density between the Gold Medal and Standard Regulation reaches on the Animas River.

There are six primary factors that may limit trout populations. These are:

1. Food or energy sources
2. Harvest
3. Physical Habitat
4. Flow Regime
5. Water Quality (dissolved metals, sediment, temperature)
6. Biotic interactions (predator/prey interactions as well as competition)

There are a several limiting factors that are unlikely to significantly influence trout densities in the Animas River. The condition factors of most trout in the Animas River is average suggesting fish are getting adequate food resources and, by extension, the macroinvertebrate community is relatively productive (however, it may not be diverse). However, gaps in food production or unmet dietary needs while trout are transitioning between Age 2 and beyond are of concern and need further investigation.

Physical habitat conditions have not changed much in the last 20 years. Improvements to the fish habitat and bank stabilization were made in 2009 just upstream of the Highway 160 bridge. However, the physical habitat was negatively altered with the installation of the Durango Whitewater Park in the winter of 2013/14 but that reach of Gold Medal water was steep with high water velocities and probably not very good habitat compared to the rest of the reach. Major physical shifts in the trout habitat in either reach do not fully explain the decline in trout density, biomass, or quality.

Angler harvest influences trout densities and demographics. In the Animas River trout harvest occurs but is not significant. A 2012 creel survey suggests the harvest rate on trout is less than 2%. Over 98% of those surveyed were catch and release anglers. Catchable trout are stocked in the Standard Reach to off-set harvest of wild fish. "Left over" or uncaught catchables are a common occurrence in our electrofishing surveys.

Flow regime describes the pattern of a series of annual discharges in the Animas River. Key points in an annual discharge curve are the duration, variation, and intensity of the spring runoff and stability of baseflows starting typically in late June or early July. In general, trout populations are sensitive to highly variable flow regimes and stable baseflows provide optimal growing conditions for trout of all age classes. For example, the Gunnison River above Blue Mesa Reservoir has a very stable trout population. The Gunnison has a similar discharge to the Animas River in terms of quantity of water and the general snowmelt pattern (Figure 10) but the variation within the hydrologic year on the Animas River can be enormous (Figure 11).

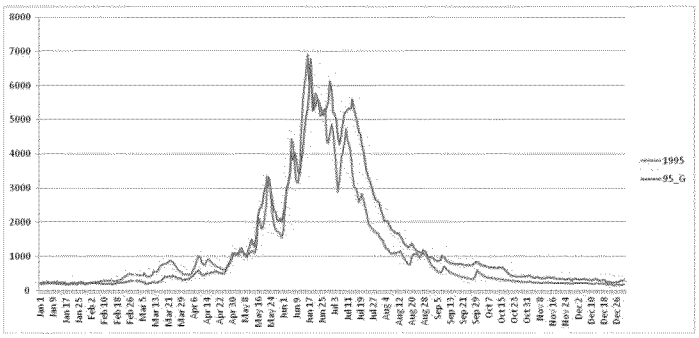


Figure 10. Annual discharge on the Animas (blue line) and Gunnison (red line) during 1995.

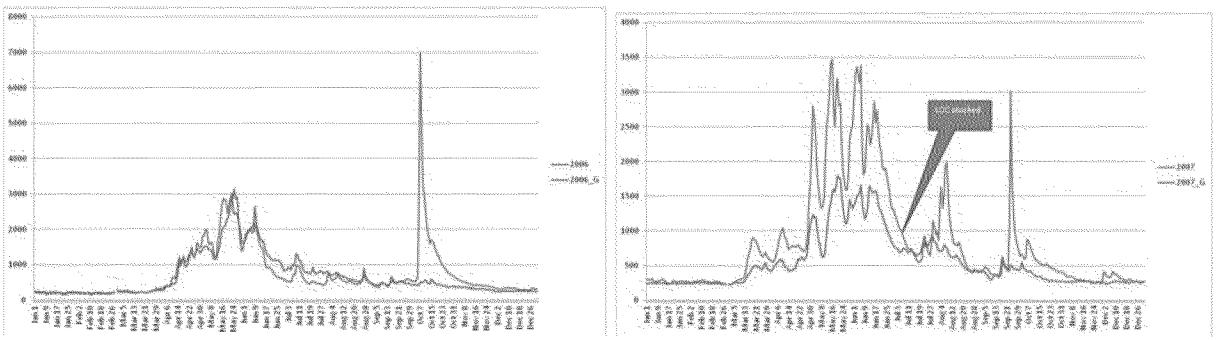


Figure 11. 2006 and 2007 water years on the Animas (blue line) and Gunnison (red line) rivers. Y axis is discharge in cubic feet per second (cfs).

There is a weak link between intra-annual variation in the Animas River discharge associated with high spring peaks and monsoonal rainfall events and the loss of some young year classes of trout. For example, in 2005 the Animas River peaked at over 8,000 cfs (the Gunnison peaked at a little over 3,000 cfs that year). Age-0 and Age-1 brown trout were relatively abundant in 2004 (same year classes of rainbows were rare). In 2006 when we checked the river those Age-0 and Age-1 trout should have been Ages 2-3 (or around 260-360 mm) and they were well represented in the catch. The weak age classes of rainbow trout seen in 2004 were observed in the lack of the Age 2&3 rainbows during the same 2006 survey. It appears the high spring peak of 2005 had little appreciable effect on trout in the Animas.

However, in 2006 we had the second highest fall flooding since 1916. That year the river peaked at 7,000 cfs on October 7th (after electrofishing surveys were completed that year but probably before the brown trout spawn). In 2008 the young fish that were subjected to the fall flood would have been Age 2&3 year classes. Those age classes in the 2008 survey are depressed (Figure 12). The intense flooding of 2006 may have depressed trout densities poised to become larger quality sized fish in the Animas River but it was not a devastating blow to the fishery.

This year our survey showed very few Age-0 or Age-1 brown trout. There were no highly unusual flooding events that occurred between 2012, when young brown trout were very abundant, and 2014 to explain the low density of these fish. To avoid discharge related losses of fish, all of the fingerling trout stocking occurs as the peak spring flows are descending at the end of June to July. Fall flooding does affect the recruitment of young fish but most of the stocked fish probably weather these events with little significant overall losses to the Animas River.

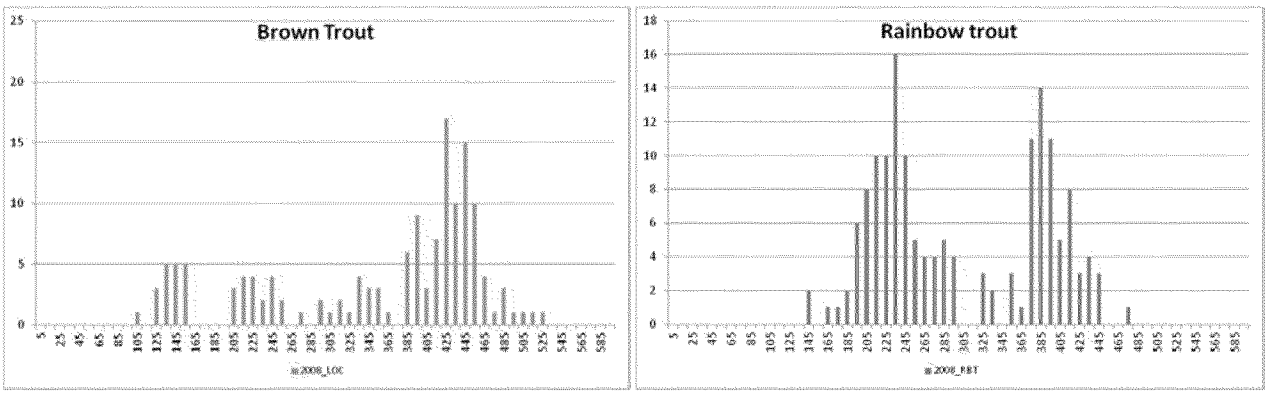


Figure 12. Length frequency charts of brown and rainbow trout in the Animas River post 2006 fall flooding.

Water quality has changed on the Animas River since about 2004. A number of mitigation efforts in the Upper Animas River since the early 1990's were successfully completed by mining companies, the Animas River Stakeholders Group (ARSG), and federal land management agencies. Initially, these projects resulted in an overall reduction of dissolved heavy metals into the Animas River. One of these projects near the headwaters of Cement Creek above Silverton included placing concrete bulkheads in the American Tunnel to staunch the discharge of metal laden water into the creek. Between 1996 and 2004, a water treatment plant operated to treat any residual mine drainage while the company completed a number of other projects to offset the residual leakage. In 2004 the treatment plant was shut down after the last bulkheads were installed and several mine adits above the bulkheads began discharging polluted water in much larger quantities than before. Dissolved zinc and cadmium levels (among others) are substantially worse now in the Animas River below Silverton than they were previously.

The decline in water quality in the upper Animas River is clearly seen in downstream fish populations. The closest reach typically occupied by fish downstream of Silverton is Teft Spur, located just upstream of the Cascade Creek confluence. Between 1992 and 2005 (N=3 sampling occasions), brook trout densities averaged 345 fish/mile and in 1998 brook, rainbow, brown, and cutthroat hybrids were present at the site. From 2010-2014 (N=2 surveys), brook trout populations average 84 fish/mi and rainbow and cutthroat hybrids have been extirpated (brown trout are extremely rare). The trout population has declined almost 80% from baseline conditions.

The decline of trout at the Teft Spur site is not the result of declining baseflows and habitat conditions in the Animas River. A baseline survey conducted in the Animas River above Silverton shows a small dip in the average density of brook trout from 649 fish/mi since 1992 to an estimated 502 fish/mile this year. Although the density of brook trout at this site dropped about 50% from the estimate in 2010 there were multiple age classes of fish present suggesting all of the conditions need for reproduction and recruitment are present. At the Teft Spur site only adult fish were captured; relatively good juvenile habitat is present at this site. The presence of a decent brook trout population above the influence of Cement Creek and a drastically reduced population of brook trout below provides good evidence that the increase in dissolved metals in the Upper Animas River is affecting the fishery.

The water quality picture in the Animas River running through Durango is complex. By the time water from the Animas River headwaters reaches Durango several large tributaries, including Cascade and Hermosa creeks, bring in high quality water with buffering properties from abundant limestone in those drainages. Currently, dissolved metal water quality standards designed to be protective of fishes are exceeded at the Baker's Bridge location 17 miles north of Durango and above the Hermosa Creek confluence, but are met at Trimble Lane (~10 miles north of town) and down through Durango. Dissolved metal water quality standards are not exceeded below Durango.

Although there is currently no measured direct connection between the discharges of heavy metal laden water in the Silverton Area and the Animas River fishery through Durango, there are substantial and additive impacts to the water quality that are occurring with increasing frequency that likely affect fish in the Animas River. An often quoted saying is that "dilution is the solution to pollution". Routine fish monitoring and stocking started in the early 1980s. The peak of the brown trout biomass and density in the Animas River was in 2000. If we compare the amount of water the Animas River produced from 1985-1999 and the proceeding 15 years afterward, you get a 22% drop in the overall amount of water in the river. The decline in the amount of water available for fish is most notable during the summer months when the peak of the growing season occurs. Since 2000, the Animas River has produced almost 40% less water during these critical baseflow months than in the preceding 15 years (Figure 13). Because of warmer springs and dust on snow events, the peak of the hydrograph has started to shift from June to May in the last 10 years leaving less snow, and water, in the higher elevations to support baseflows. The quality of water is directly affected by the quantity of water; the trout population in the Animas River is a good barometer of both variables.

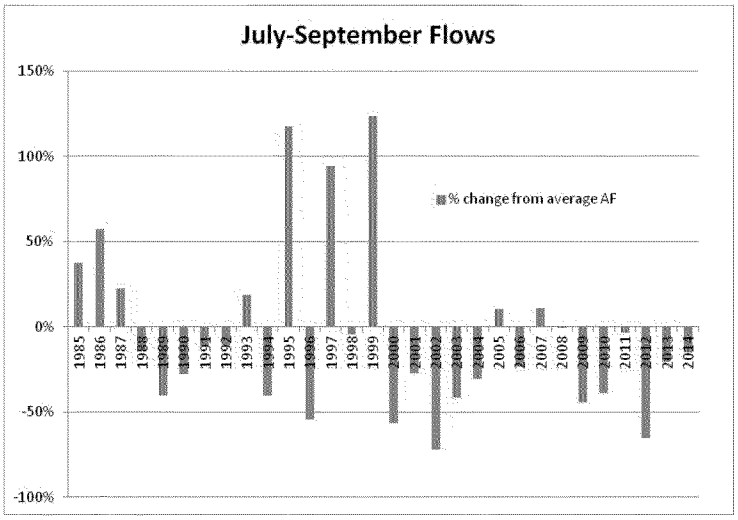


Figure 13. The sum of the acre feet of water produced by the Animas River in Durango between July and September expressed as percent change from average conditions during the same months (1916-2014).

Development and use of the Animas River has increased which can affect water quality. The population of La Plata County almost doubled from about 27,000 people in 1980 to an estimated 53,000 people in 2013. Conversion of agricultural lands to subdivisions has occurred throughout the county to accommodate the increased growth including large subdivisions in the Animas River valley north of town. Increases in inorganic nitrogen which can spur harmful algal blooms and cascading effects in pH and dissolved oxygen is often associated with agricultural use and/or increased development. Since 2003, inorganic nitrogen has increased every year, particularly in March when the snow melts off low elevation areas near the Animas (Figure 14). Increased traffic, impervious surfaces associated with roads and development, and channelizing natural drainages to accommodate land use also adds to the overall introduction of fine sediments and pollutants from city streets into the river.

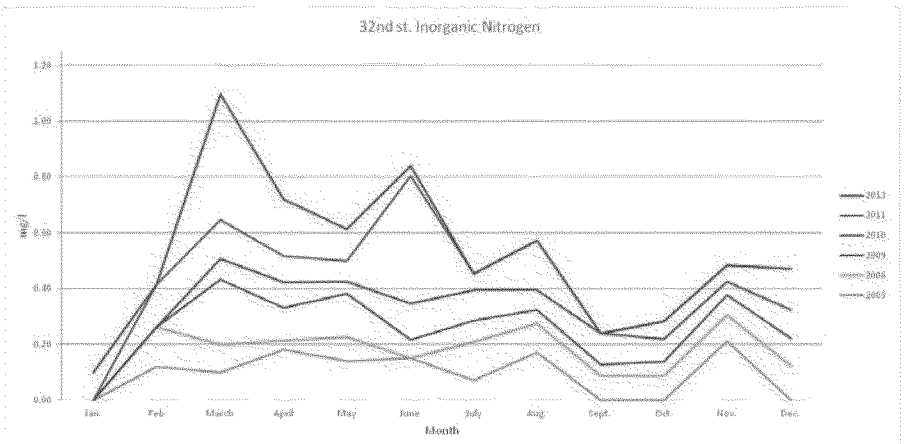


Figure 14. Inorganic nitrogen at 32nd Street Bridge in Durango, CO.

General use of the Animas River by the public has increased. The Animas River has become a focal point for both residents and visitors. The Durango Area Tourist Office estimates that over 900,000 people visited Durango in 2011 (51 times the current population of Durango). The commercial rafting industry estimates 41,000 user days a year on the River. That does not account for substantial number of private trips that occur on the river each year. Anecdotally, the popularity of tubers on the river during the low water summer months has skyrocketed. Between 1985 and 1991, I lived in Durango. The thought of tubing down the Animas River never even occurred to me or my colleagues. I do not recall ever seeing anyone tubing despite spending a lot of

time on the water in a kayak during those days. During the low water years starting around 2000 (Figure 13) local rafting companies started renting tubes because they could not navigate the river with rafts. In 2012, CPW counted tubers on the river as part of a systematic angler creel census and estimated that over 13,000 tubers went down the Animas River (mostly in the Animas River #2 section). Between mid-June to mid-August tubers outnumbered anglers 9 to 1.

The distinction between tubers and other users of the Animas River is important. Tubing occurs at low water during the summer months when trout are actively feeding and growing. Tubing is most attractive when water temperatures are warm which coincides with the most stressful part of a day for a trout. Tubers are frequently out of there tubes wading to dislodge their craft from rocks which is a disruption to the bottom sediments, invertebrate community, and fish. Rafts and kayaks are much more maneuverable and that activity occurs primarily during higher flows when much of the channel is covered with water and water temperatures are low. Finally, tubers directly compete for space with anglers on the river (Figure 14).

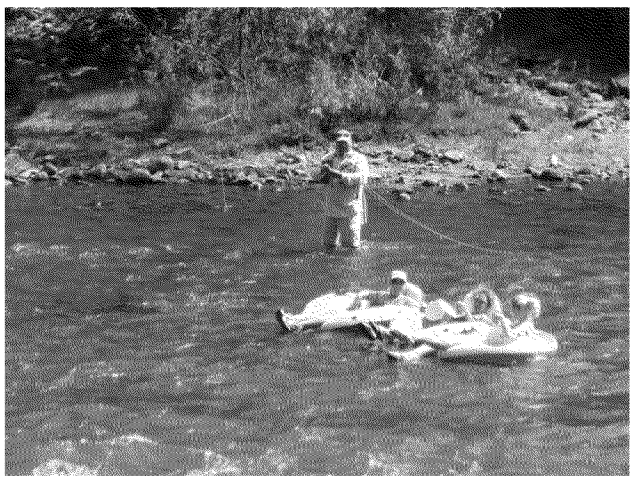


Figure 14. Fly fisherman and tubers on the Animas River.

Trout need clean, cold water with sufficient depth, water velocity, and cover to thrive. The cumulative effects of less water, more pollutants, and more activity in the river run counter to good trout production. The demographics and use of the Animas River through Durango is different than it was 15 years ago. Increases in land and water development (i.e., Animas-La Plata pumping for Lake Nighthorse) as well as climate change will continue to negatively affect the trout fishery in the Animas River unless mitigation efforts succeed in countering some of these effects.

Questions about the strain, size, number, and biological interactions of recently stocked "Hofer Crosses" or HXC rainbows are often brought up at community meetings. The HXC rainbow trout is a wild rainbow crossed with a highly domesticated but whirling disease (WD) resistant fish. The goal of using this fish is to establish a wild population of whirling disease resistant fish in the river and reduce the overall loading of WD spores in the Animas. Anglers often associate the decline in the Animas River fishery with the stocking of these rainbow trout started in 2009 as mitigation for the Animas-La Plata project (Lake Nighthorse). Questions about inferior fitness of the rainbow trout strain are typically cited. However, CPW is starting to see gains in rainbow trout populations in the Gunnison, Arkansas, S. Platte, Rio Grande, and Poudre rivers using HXCs. Most notably, the expression of the "wild" part of the genome over the domestic Hofer part in Colorado streams that support natural reproduction is occurring. Although recruitment of HXCs is typically low (around 1%- 2%), it does not appear that the general fitness of the HXCs are vastly different than previously used strains of fish in the Animas River or any other river in Colorado.

Stocking on the Animas River Standard and Gold Medal reaches is necessary to compensate for poor natural reproduction by trout. Stocking numbers have not appreciably changed much since recommendations based on CDOW research were made in the early 1990s. The average number of rainbow and brown trout stocked from 1996-2008 was about 25,930 RBT/year and 26,200 LOC/year. After Animas-La Plata project mitigation stocking of HXCs started in 2009 we stock about 5,000 more rainbows per year than before. Since 2009 brown trout stocking has declined about 24% on a typical year. The number of brown trout stocked is highly dependent on a wild spawntake that occurs every year in North Delany Butte Reservoir. Variability in wild spawntakes (i.e., number of eggs/fish produced for stocking) is normal. Stocking rates in other Colorado Rivers range typically from 100 to 250 fish per surface acre. Because there is so little natural reproduction, CPW stocks the Animas at the upper end at 227 fish/surface acre.

Since 2009 the average size of rainbow trout stocked has increased from 3.0 inches to 3.9 inches. Brown trout stocked size has changed since 2006 from an average size of 4.7 inches to 3.1 inches. The decline in the average sized stocked brown trout in the Animas River is a result of increasingly short hatchery space (it takes less space to raise smaller fish) due to an ever increase in the demand for new conservation and management stocks of trout. A review of the research conducted by Barry Nehring in the late 1980s, suggest stocking larger brown trout improves recruitment from 1% up to 25%. However, Nehring did not find as clear a correlation between the size of rainbow stocked and recruitment. Most managers recommend stocking larger rainbows in a river occupied by large brown trout to avoid excessive predation. The erosion in the size of brown trout stocked in the Animas River is a variable we will address this year.

A number of aquatic managers in Colorado have manipulated the sizes of HXCs stocked based on the relationship between larger fish and increased domestication behaviors. The general consensus emerging from these investigations are stocking lots of very small 1 to 1.5 inch fish in fry habitat promotes the development of wild fish resulting in better recruitment and higher density rainbow trout populations unless fry habitat is limited and you have a large established brown trout population. If you have relatively limited fry habitat and lots of brown trout, then stocking 5-6 inch HXCs appears to work better (i.e., Arkansas River). The Animas River falls into the latter category: not much fry habitat and lots of large browns (at least back in 2008 that was the case). So looking back, stocking larger HXC was a sensible strategy. In the last several years, we have moved to stocking a smaller HXC based primarily on availability but also based on the notion that you get a wilder less domesticated fish if you stock them smaller. With the decline in the density of brown trout, and despite the lack of high quality fry habitat, this should have been a fruitful stocking strategy given what we know about HXCs now. And, it turns out, rainbow trout density and recruitment is up but bottlenecks right around Age 2 fish (Figure 3). Both large (5-6 inch) and relatively small (3 inch) HXCs have been stocked in the Animas River with little success at getting them up to quality size (14 inches).

Competition between young rainbow and brown trout may occur in the Animas River but to what extent is not known. They both occupy similar habitats but juvenile brown trout are much more tied to instream cover than rainbow trout. With low baseflows, there may be a competitive edge for young rainbow trout over brown trout particularly when the rainbows are stocked at a larger size. In other Colorado streams, predation by larger brown trout on young rainbow trout is a controlling factor on recruitment. With the density of larger browns so low on the Animas, it may explain why we see such high numbers of young rainbows but it does not explain the lack of rainbow trout recruitment beyond 2 years when most are not as susceptible to predation. The biological interactions between newly stocked rainbow and stock brown trout is difficult to tease apart but it is unlikely the rainbows have as big a competitive edge over the young browns as observed in this year's survey results.

MANAGEMENT RECCOMENDATION SUMMARY

1. Management: Continue to manage the Animas River #1 (GM reach) as category 406 "Coldwater special regulation stocked stream". Continue to manage the Animas River #2 (ST reach) as a category 405 "regularly stocked with any fry/fingerling/subcatchable salmonids" with standard regulations applied. Continue to monitor and assess on even years and coordinate with SUIT.
2. Stocking: continue to stock 10,000 HXC and 10,000 LOC fingerlings by raft each year in each section. Use A-LP mitigation HXCs for stocking. Stock HXCs post-runoff at 3 inches or less. Help S. Ute's mark HXCs with coded wire tags at Basin Creek site. Stock LOC post runoff at 5 inches or more. Mark larger brown trout prior to stocking with an adipose clip. Target fry/juvenile habitat when stocking. With HXC's instill olfactory predation avoidance behavior by sacrificing a few fish in the holding tank just prior to stocking.
3. Regulations: No change. Special regulations are not warranted in the ST regulation reach and the 16 inch minimum with a 2 fish limit is not limiting the population of large trout in the Animas River.
4. Habitat Improvement: Focus on water quality improvements. Continue to advocate for cleanup efforts in the Silverton Area by working with the EPA and stakeholder groups to obtain fishery data useful in mitigation negotiations with the mining companies Important fishery data include:
    a. Population estimates of juvenile and adult fish in historic upper Animas River sites
    b. Continue to monitor temperature
    c. Repeat of 1996-1999 fry shocking at 7 sites from High Flume Canyon to Baker's Bridge (collaborate with CPWs, Dan Kowalski and the S. Ute Indian Tribe)
    d. Collect fish for heavy metals tissue analysis (collaborate with CPWs, Pete Cadmus, and EPA, CDPHE, WQCD, and other stakeholder groups)
    e. Collect macroinvertebrate samples as water quality indicators (collaborate with Pete Cadumus, EPA, WQCD, CDPHE, and other stakeholder groups)
    f. Review 404 permit applications and mitigate impacts to habitat with instream cover projects
5. Access/ Facilities: Continue working with the Animas River Task Force on Animas River issues.
6. Information and Education: Continue disseminating updated information internally and to stakeholder groups. Manage expectations of fishery; i.e., drought and low flows are hard on fish.
7. Other: replace old regulation signs

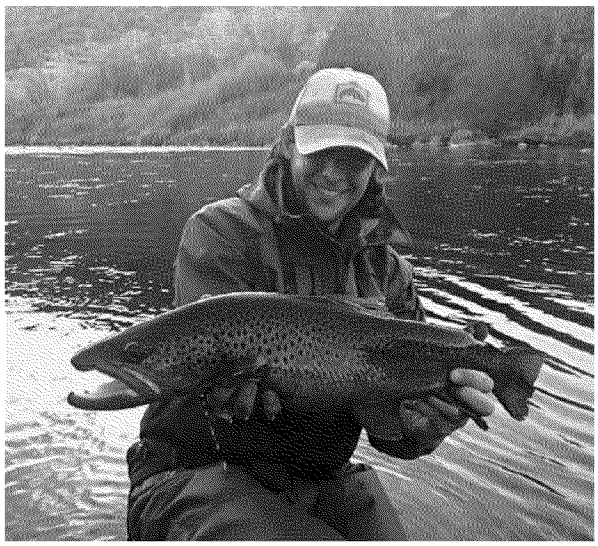


Photo 1. Large brown captured in 2014 on the Animas River.

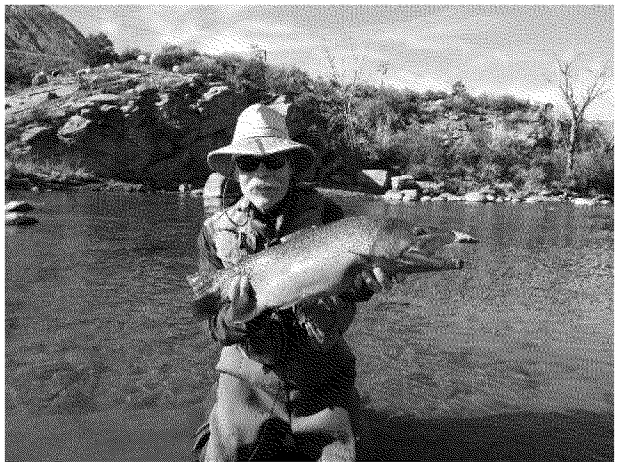


Photo 2. Nice rainbow capture just below High Bridge in the GM section, 2014.

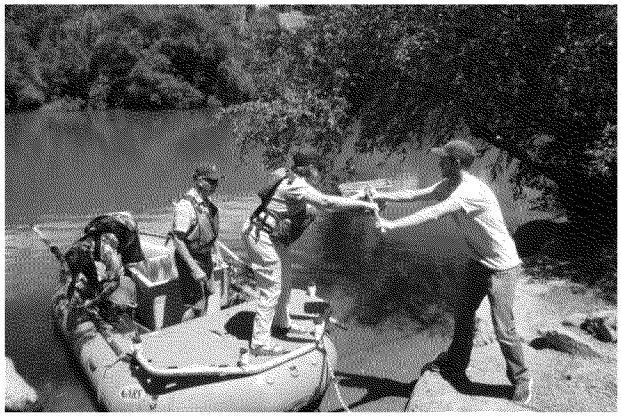


Photo 3. Raft stocking the Animas.

Photo 4. Pete Deren (netting) and Dan Cammack throwing trode during 2014 mark and recapture survey.

Photo 5. Steph Schuler moving fish, Kara Hellige (ACOE) watches an approaching storm, and Mike Japhet is weighing a measuring fish. Jerry McBride (Durango Herald) looks on.

Photo 6. Pete Deren holds a large brown in a rainstorm; Dan Cammack looks on.

Photo 7. Drayton Harrison (back turned) talks to Steve McClung (right) and Mike Japhet during a downpour. New Mercury Building in background.

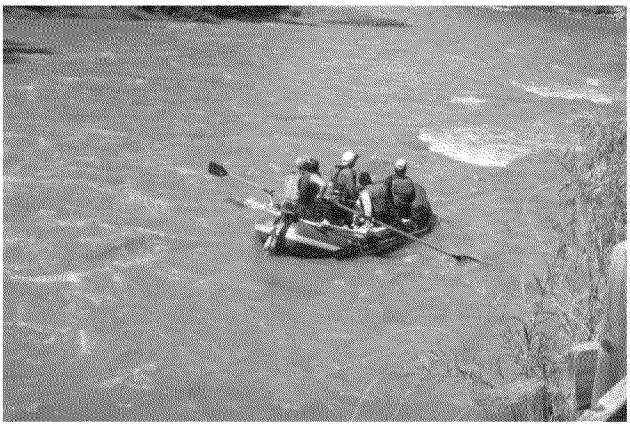


Photo 8. High water precluded recapture run on Animas #2 until 10 days later on 9/18.

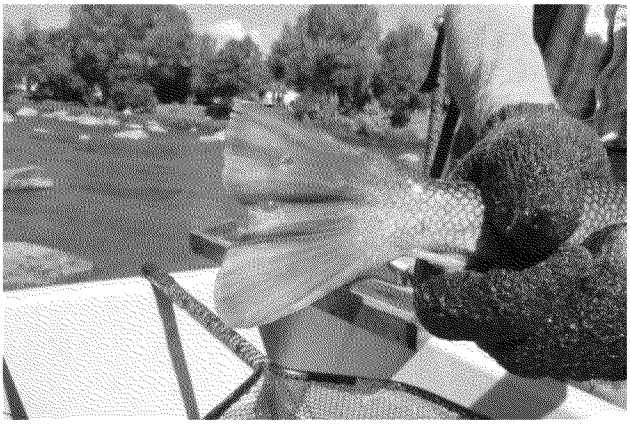


Photo 9. Recaptured bluehead sucker.

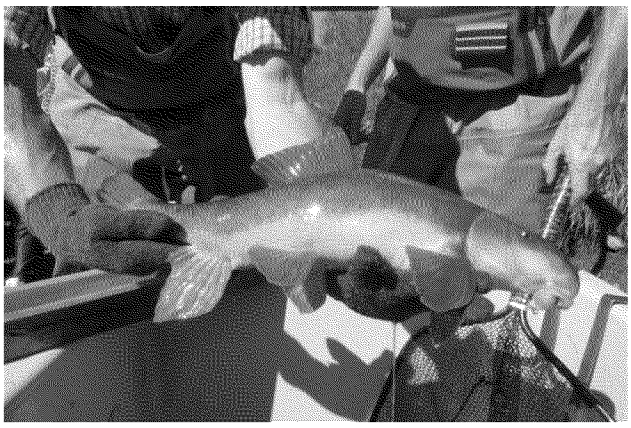
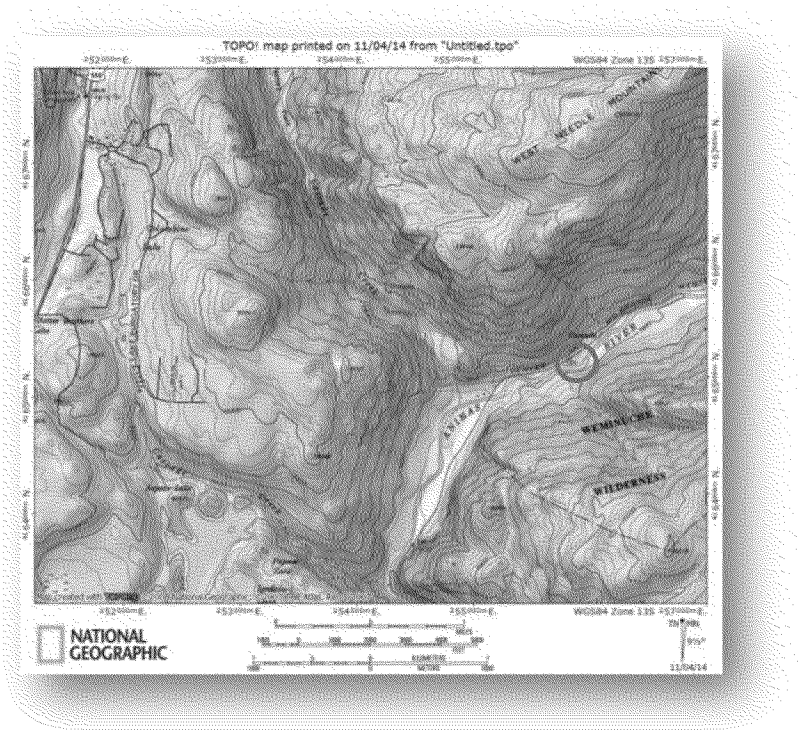


Photo 10. Large flannelmouth sucker captured behind Durango High School.

ANIMAS RIVER #3 (Teft Spur)

Jim N. White
Aquatic Biologist
Southwest Region

Water: Animas River #3
Sampling Date: 9/24/14
Gear: Bank Electrofisher
Drainage: San Juan
Water Code: 38009



OBJECTIVE

To assess the fish population in an 800 ft reach of the upper Animas after documented declines in the Animas River water quality.

HISTORY

The upper Animas River is heavily impacted by dissolved heavy metals including zinc, copper, cadmium, arsenic, lead, and iron (among others; Photo 1). The source of these metals is both mining and natural. Fish densities are extremely low below Silverton (Cement Creek), but there is a relatively robust brook trout population that occurs above town in the main stem of the Animas near Howardsville.

The Animas River Stakeholder Group (ARSG), federal agencies, and mining companies have completed some mitigation measures to limit the pollution with varying success. The largest of these measures failed in 2004 and water quality now is worse than it was before those measures were put in place. The EPA designated the upper Cement eligible for "Super Fund" clean up funding but the town of Silverton is opposed to the designation. Currently, the EPA plans to spend $1.5 million to plug the worse mine adits in the Cement Creek headwaters.

There are four historic fish sampling sites in the Upper Animas that are routinely monitored for presence/absence and abundance of fishes. From upstream to downstream these are Howardsville (4 miles NE of Silverton, A72 (just below Silverton and the Mineral Creek confluence), Elk Creek Spur (site located just above the confluence with Elk Creek, and Teft Spur (1/2 mile upstream of Cascade Creek confluence – see map). These sites have been monitored 5 times since 1992. Stations are monitored by bank shocking a 1,000 ft section of stream and a 2 pass removal estimator is used to calculate density

and biomass. Rail transportation is required to get into the Teft Spur and Elk Park Wye stations (Photo 2).

RESULTS

Only Teft Spur and Howardsville sites were sampled this year and no sites were sampled last year. Flows from recent monsoonal storms pushed the river up past 200 cfs in both 2013 and 2014 (Figure 1). However, we were able to safely wade the Teft Spur site on 9/24/14 when the river was running 261 cfs below Silverton. The Teft Spur site is located in a side-channel off the main stem of the Animas River which would not be safe to wade at most flows (Photo 3 and 4).

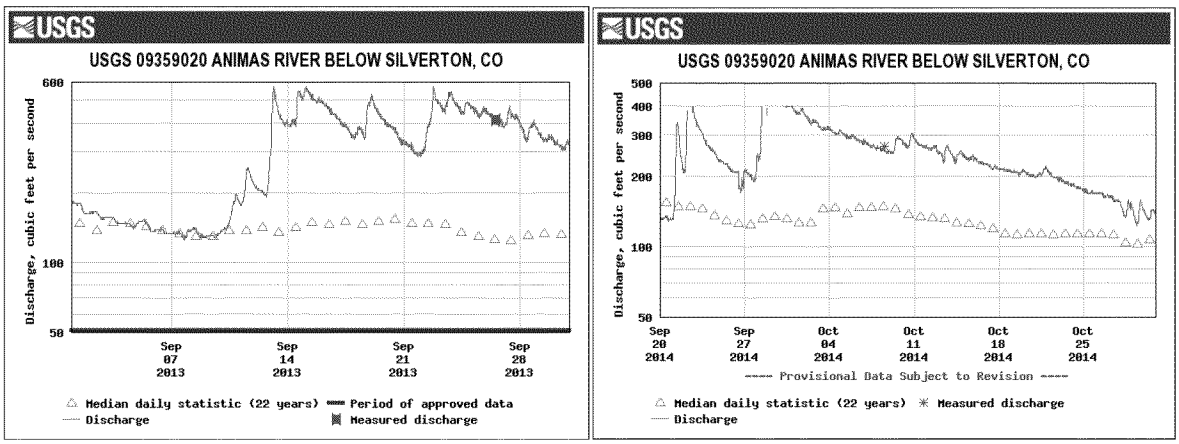


Figure 1. Flows at the Silverton (A-72) gauge during a planned 2013 shocking effort and during this year's effort. Flows need to be below about 175 cfs to safely wade the Elk Creek and A-72 sites.

A total of 9 brook trout and 2 brown trout were captured in this 700 ft electrofishing station during 2 passes (Table 1). With the exception of 1 juvenile brook trout all of the fish were adults (Figure 2). Brook trout relative weight was 96 and brown trout relative weight was 107. Relative weights should be higher than 100 for adult fish this time of year because of the impending spawning season. No rainbow, cutthroat, or cutbows were captured.

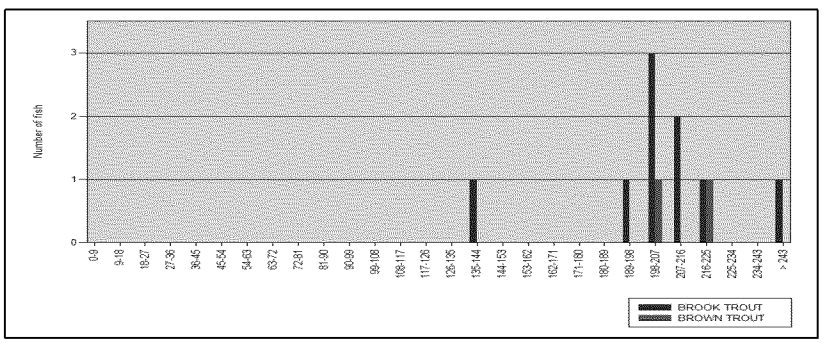


Figure 2. Length frequency of brook and brown trout captured at the Teft Spur site, September 24, 2014.

Table 1. Combined summaries of trout captured at the Teft Spur site.

Stream Sampling Summary Report

Water: 38009 ANIMAS RIVER#3

Station: SJ0058

Drainage: San Juan River

Date: 9/24/2014

Notes: Purpose of survey was to periodically monitor the fish community relative to improving or degrading water quality conditions in the Upper Animas River. Five anodes were used to shock this 700 ft long side channel. Water discharge at the A72 gauge was 257 cfs; high due to recent rains but the side channel is wadeable at these levels. We used two large motorcars and a trailer to get personnel and equipment to the site (starting at Silverton and going downstream).

Coordinates at Lower End of the Sampling Station

Zone:	X:	Y:	Elevation:
13	255440	4165047	7714 ft

Length:	Width:	Area:
700 ft	65.00 ft	1.04 ac

Effort:	Metric:	Protocol:
		TWO-PASS REMOVAL

Gear/Methods: BKEF

PROPORTIONAL STOCK DENSITY and QUALITATIVE STOCK DENSITIES

Species	Total Number	Proportional Stock Density (%)	Percent Stock Size	Percent Quality Size	Percent Preferred Size	Percent Memorable Size	Percent Trophy Size	Maximum Size (inches)
BROOK TROUT	9	0.00	100.00					9.92
BROWN TROUT	2	0.00	100.00					8.78

MEAN, MINIMUM AND MAXIMUM VALUES FOR LENGTHS AND WEIGHTS

SPECIES	Total Sampled	Mean inches	Mean lbs	Minimum inches	Minimum lbs	Maximum inches	Maximum lbs
BROOK TROUT	9	8.03	0.21	5.59	0.07	9.92	0.36
BROWN TROUT	2	8.43	0.26	8.07	0.21	8.78	0.30

RELATIVE ABUNDANCE and CATCH PER UNIT EFFORT

Species	Total sample	Population >=cutoff	Population all sizes	Weight Lb	Percent Number	Percent Weight	Catch per Unit Effort Number/Effort	Catch per Unit Effort Lbs/Effort
BROOK TROUT	9	9	9	1.99	78.95	79.59		
BROWN TROUT	2	2	2	0.51	17.54	20.41		

RELATIVE ABUNDANCE and BIOMASS ESTIMATES

Species	Total sample	Population estimate	Weight Lb	Percent Number	Percent Weight	Biomass Lb/Acre	Num/ Acre	Num/Mile	Fish samples No/Acre < T	Fish samples No/Acre >=T	T
BROOK TROUT	9	9	1.99	78.95	79.59	1.91	8.62	67.89	0	9	130
BROWN TROUT	2	2	0.51	17.54	20.41	0.49	1.91	15.09	0	2	120

CONCLUSIONS

The average density of brook trout at the Teft Spur site dropped by 76% since 2005 (Figure 3). With the exception of 2 brown trout captured this year, rainbow, brown, and cutthroat hybrids have been virtually extirpated.

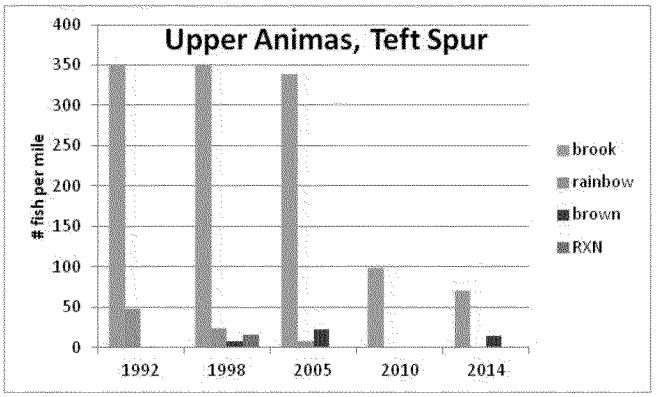


Figure 3. Density (fish/mi) of trout captured at Teft Spur since1992.

Brook trout are the most tolerant of dissolved heavy metal pollution and rainbow trout are the least tolerant. The steep and sudden decline in brook trout density and loss of rainbow trout coincides with the measured increase in dissolved toxic heavy metals in the Animas River below Cement Creek.

MANAGEMENT RECCOMENDATION SUMMARY

Management: Manage as a 302 or Wild salmonid recreation stream. Continue to periodically monitor fish population at Teft Spur.
Stocking: Stocking not recommended.
Regulations: Standard Regulations; no change.
Habitat Improvement: Work with EPA to improve water quality in Silverton by providing needed data to demonstrate downstream conditions.
Access/ Facilities: None.
Information and Education: Use data to illustrate the harmful effects of toxic dissolved heavy metals on fish populations and specific fish species.

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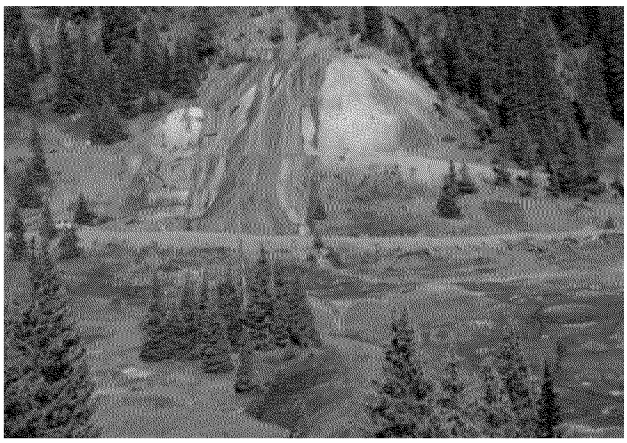


Photo 1. Heavy metal laden water pouring out of the Bonita Mine near Silverton.

Photo 2. Equipment and personnel transportation.

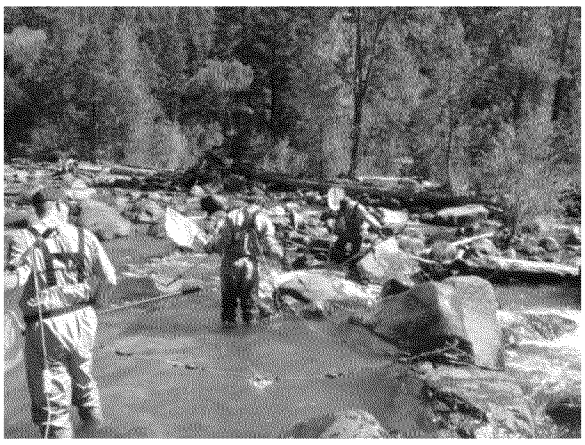


Photo 3. Mid-station in the Teft Spur side channel.

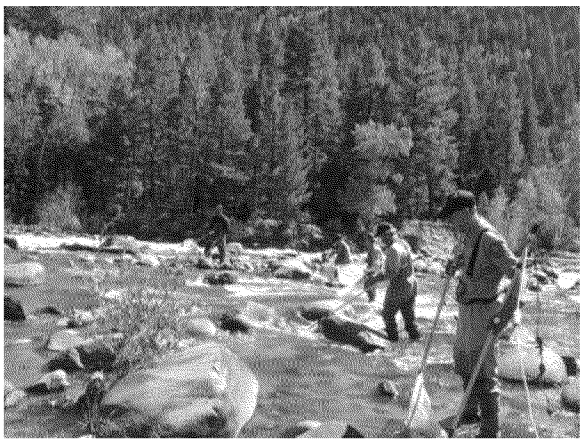


Photo 4. Top of side channel at Teft Spur. Steve McClung in foreground.

Photo 5. Brook trout captured in reach.

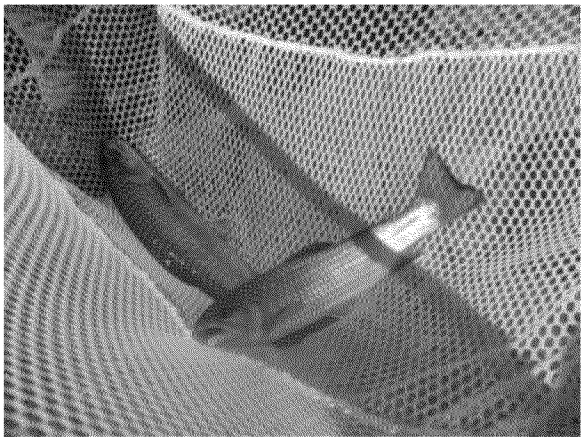
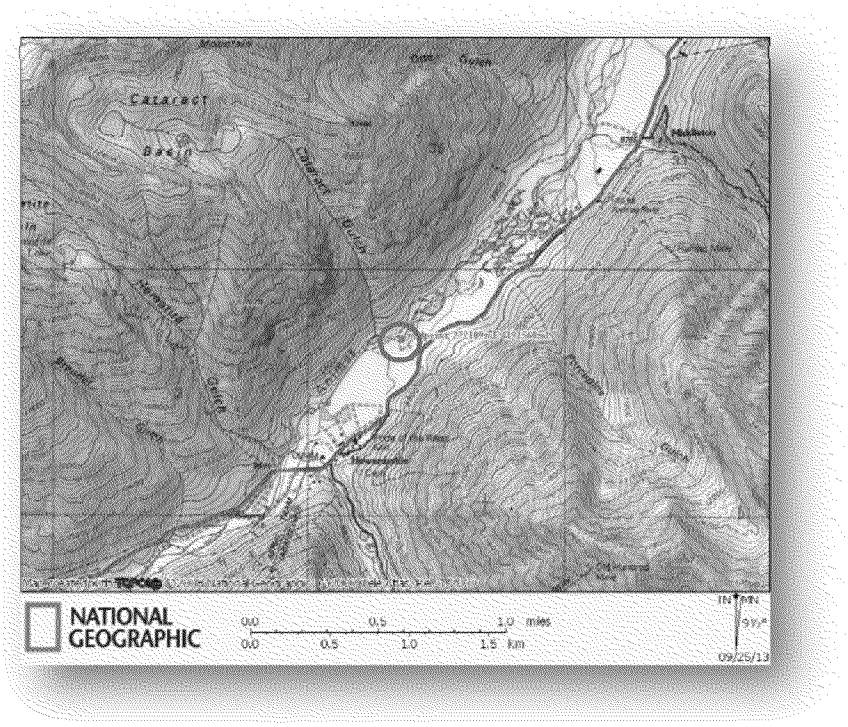


Photo 6. Brown trout captured in reach.

ANIMAS RIVER #4 (Howardsville)

Jim N. White
Aquatic Biologist
Southwest Region

Water: Animas River #4
Sampling Date: 9/25/2014
Gear: Bank Electrofisher
Drainage: San Juan
Water Code: 38011



OBJECTIVE

To assess baseline fishery above the worst dissolved heavy metal discharges in Cement Creek.

HISTORY

A short section of river above Howardsville (see map at right) is capable of supporting brook trout. This section of the Animas River historically was heavily impacted by in-channel disturbance from nearby mining activities as well as acid mine drainage and dissolved heavy metals. However, the water quality and habitat conditions have improved since monitoring efforts began in 1992. The reach, as well as nearby Cunningham, Maggie, and Minnie (Gulches) creeks, now supports reasonably high densities of brook trout for streams at this elevation.

RESULTS

A total of 162 brook trout were captured. No other species of trout was present. The density estimate was 501 fish per mile, down about 54% from the 2010 estimate. The lower density of trout resulted in higher condition factors for the brook trout. Relative to other brook trout populations, trout in 2010 were about 85% of their weight versus 102% this year. Improved relative weights suggest a density of about 500-600 fish per mile is probably close to the carrying capacity of this reach of stream.

Multiple age classes of brook trout were present in both 2010 and 2014 (Figure 1). A relatively abundant class of Age 0 fish were captured this year suggesting spawning conditions were good in the fall of 2013.

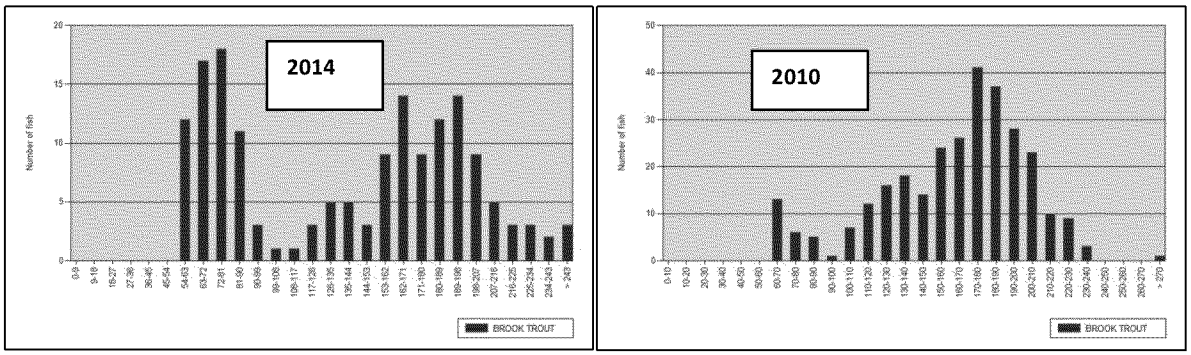


Figure 1. Length frequency of brook trout in 2014 and 2010 just upstream of Howardsville.

Table 1. Summary report for the Howardsville reach on the Animas River above Silverton.

Stream Sampling Summary Report

Water: 38011 ANIMAS RIVER #4		**Coordinates at Lower End of the Sampling Station**		
	13	X:	Y:	**Elevation:** 9681 ft
Station: SJ0057	**Zone:**	271942	4191509	
	Length:	**Width:**	**Area:**	
Drainage: San Juan River	1000 ft	41.00 ft	0.94 ac	
	Effort:	**Metric:**	**Protocol:**	
Date: 9/25/2014			TWO-PASS REMOVAL	
	Gear/Methods: BKEF			

Notes: Purpose of survey was to assess a population of brook trout in the upper Animas River drainage relatively unaffected by poor water quality. Stream discharge at the Howardsville gauge was 73 cfs.

PROPORTIONAL STOCK DENSITY and QUALITATIVE STOCK DENSITIES

Species	Total Number	Proportional Stock Density (%)	Percent Stock Size	Percent Quality Size	Percent Preferred Size	Percent Memorable Size	Percent Trophy Size	Maximum Size (inches)
BROOK TROUT	85	0.00	100.00					9.72

MEAN, MINIMUM AND MAXIMUM VALUES FOR LENGTHS AND WEIGHTS

SPECIES	Total Sampled	Mean inches	Mean lbs	Minimum inches	Minimum lbs	Maximum inches	Maximum lbs
BROOK TROUT	85	7.40	0.17	5.91	0.08	9.72	0.41

RELATIVE ABUNDANCE and CATCH PER UNIT EFFORT

Species	Total sample	Population >= cutoff	Population all sizes	Weight Lb	Percent Number	Percent Weight	Catch per Unit Effort Number/Effort	Catch per Unit Effort Lbs/Effort
BROOK TROUT	85	95	172	16.29	100.25	100.00		

RELATIVE ABUNDANCE and BIOMASS ESTIMATES

Species	Total sample	Population estimate	Weight Lb	Percent Number	Percent Weight	Biomass Lb/Acre	Num/ Acre	Num/Mile	Fish samples No/Acre < T	Fish samples No/Acre >=T	T
BROOK TROUT	85	95	16.29	100.25	100.00	17.31	100.93	501.60	82	90	150

CONCLUSIONS

Brook trout density declined in 2014 relative to the last survey done in 2010 (Figure 2). Although this was a steep drop the body condition of the fish suggest it was not due to a loss in primary productivity in the stream associated with metal toxicity. With very limited fishing opportunities in the Silverton area, and lots of angling pressure, harvest may explain some of the drop in brook trout density at this location.

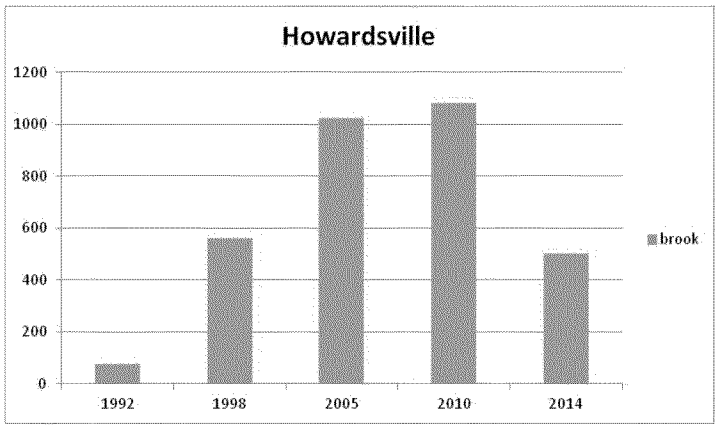


Figure 2. Long-term trends in brook trout density (trout per mile) at the Howardsville site, Animas River.

MANAGEMENT RECCOMENDATION SUMMARY

Management: Manage as a 302 Wild salmonid recreation stream.
Stocking: Not recommended.
Regulations: Standard Regulations; no change.
Habitat Improvement: Work with BLM to establish more adult holding water through habitat improvement projects. Incorporate woody debris and undercut banks in designs.
Access/ Facilities: None.
Information and Education: Highlight relatively abundant brook trout population in close proximity to heavily polluted waters coming from the Cement Creek area and the capability of expanded brook trout numbers near the Mayflower site if clean-up efforts succeed.

Photo 1. Heavy metal laden water pouring out of the Bonita Mine near Silverton.

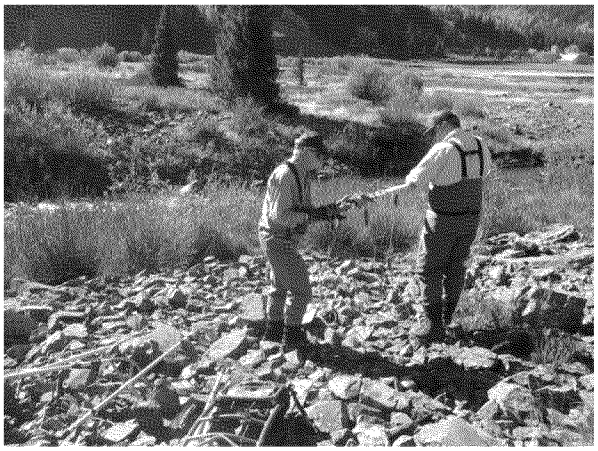


Photo 2. Mid-point of survey site; Howardsville buildings in background.

Photo 3. Looking downstream from mid-station.

Photo 4. Electrofishing above mid-point.

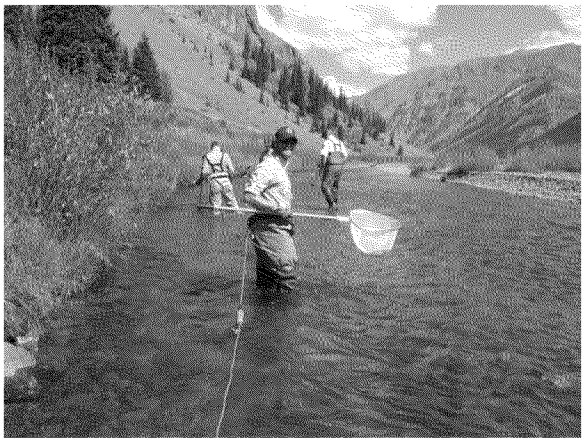


Photo 5. Top of station – typically 1000 ft plus the stretch of the anode array.